

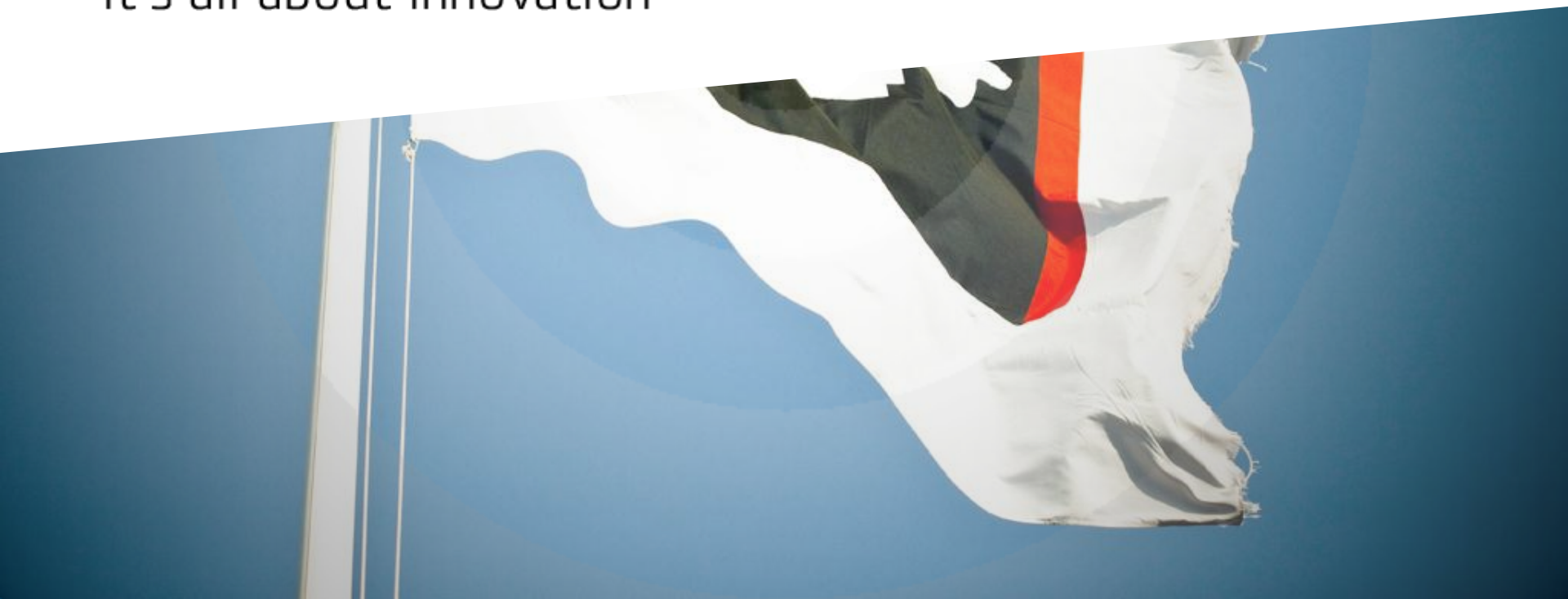
E-Mobility in the North Sea Region conference
7th March 2013



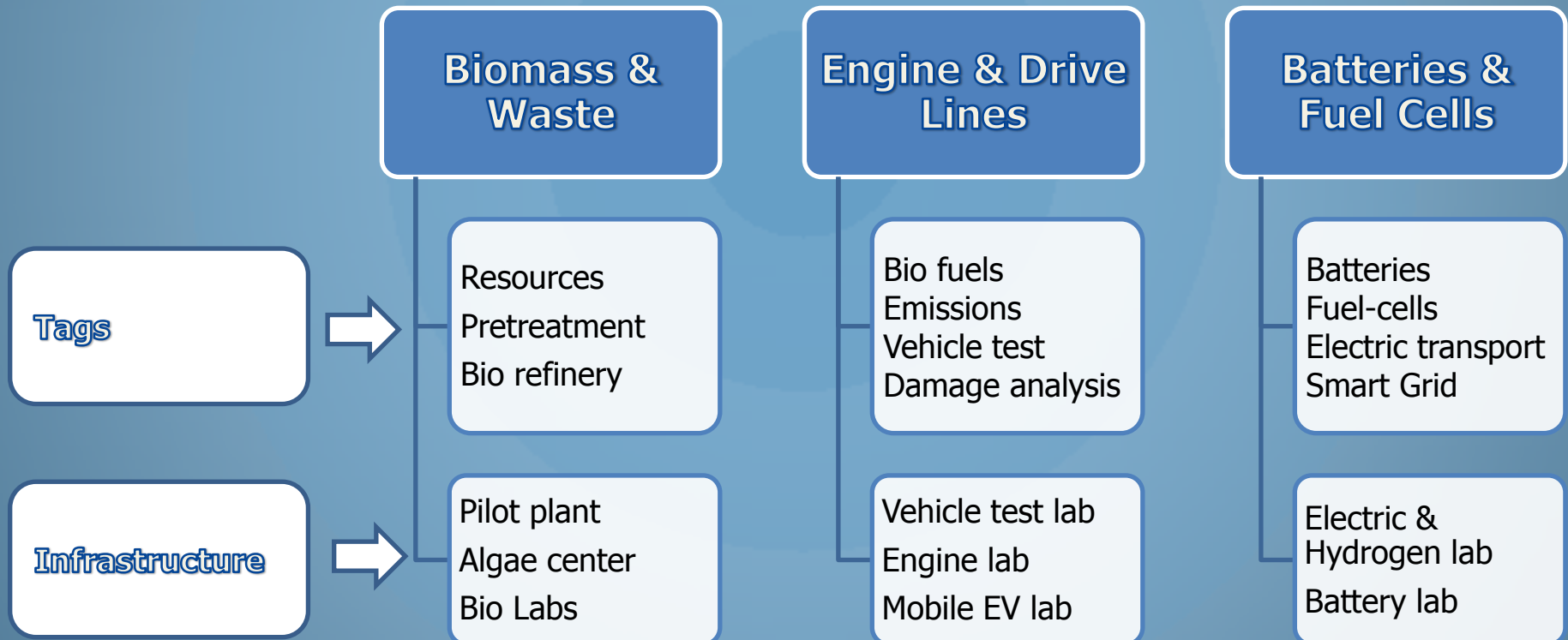
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Prøvelbil ~ Try-out an EV - an EV demonstration project

Kjeld Nørregaard
Danish Technological Institute
it's all about innovation



DTI Centre for Renewable Energy and Transport



DTI support EV research and demonstration.

Electric Vehicles are an essential measure for Denmark to reach the high goals setup for environment, climate and energy security.

The Ministry of Energy would like to have more EV on the roads, but ... what will make it happen?

- Primary car customer segment is private families
- Demonstration project "EV for EnergyFlexHouse"
 - 1 EV provided for the testfamilies staying in the flexible experimental energy focused house at DTI.



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Citroen C1EV'ie + C-ZERO



Fiat Fiorino Combi EV

Prøv1elbil ~ Try-out an EV

= EV demonstration project

- A live lab project to identify the acceptance of electric vehicles by real families.



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EV test at 81 private families



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6 EVs are lend out to private families for 3 month periods from december 2009 until end of 2012.

For first period 165 applied for 8 EVs within a small area.



- 6 EVs lend out to private families for 3 months
- 2 EVs used for community services
- 2 EVs used for test and demonstration.

- 81 families participated by end 2012.

Parallel focus on

- EV related product and business improvement potentials
- Charge interface and interaction with the electric grid
 - 9 periods with new families
 - Progressive test elements from no charge instructions to variable energy prices price

Prøvelbil consortium

- Danish Technological Institute
- NRGi Net A/S
- INSERO HORSENS
(former: Foreningen Energi Horsens)
- Horsens Kommune
- Hedensted Kommune

Eksternal sponsors:

- Danish Energy Agency – Elbilspuljen
- Region Midtjylland
- Citroën Danmark
- Ginnerup Automobiler
(og Anker Hedegaard – 24 timers hotline)



HORSENS KOMMUNE



Prøv1elbil ~ Try-out an EV -a demonstration project

- Transparent project.
- Users encouraged to state their honest thoughts regarding daily use of an EV in a Public blog



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www.elbilforum.dk

ELBILFORUM PRØV1ELBIL PROJEKTET NYHEDER OG PRESSE BLOG ELBILKLYNGE

Blog forside Min profil Seneste indlæg Sådan gør du

Seneste indlæg

Nyeste indlæg

Nyeste Mest viste Højest rating

1 2 3 4



25-10-10 17:05 | **Elbil på værksted igen**

Nå, vores lille elbil skal endnu en tur på værksted, denne gang er det batteriet det er galt med, altså det eneste der, åbentbart, ikke blev skiftet/tjekket sidst den var afsted, selvom der er blevet foretaget det der halvårige tjek. Vi har fået...

Af [tinæ](#) | 7 Visninger | 0 | ★★★★★



25-10-10 15:36 | **For lidt kilometerantal i en opladning**

I dag skulle jeg lidt længere end blot til Hedensted og retur, idet jeg på hjemvejen skulle via Stenderup og Horsens, og det var altså mere end en fuld tank kunne klare (inden for de tilladelige 25%), selv om det tilsammen kun blev til 68 km. Der...

Af [DAMSGAARD](#) | 10 Visninger | 1 | ★★★★★



24-10-10 18:01 | **Kold, kold dobbeltmur**

Med elbilen opladet til 97% kapacitet kørte vi her i eftermiddag fortrøstningsfuldt mod Forum Horsens for at se Flying Superkids! Temperaturen udenfor sagde 7 grader, så vi tændte for varmen i bilen, så det kunne blive en hyggelig og varm køretur...

Af [gittepinholt](#) | 13 Visninger | 1 | ★★★★★



24-10-10 13:24 | **Bytte bil**

Jeg bytter gerne vores C1 bil ud for denne Nissan Den har ihvertfald den batterikapacitet som flere af os efterlyser. Se nærmere her: <http://beep.tv2.dk/entry.php/id-386477.html>

Af [KimErfurt](#) | 14 Visninger | 0 | ★★★★★

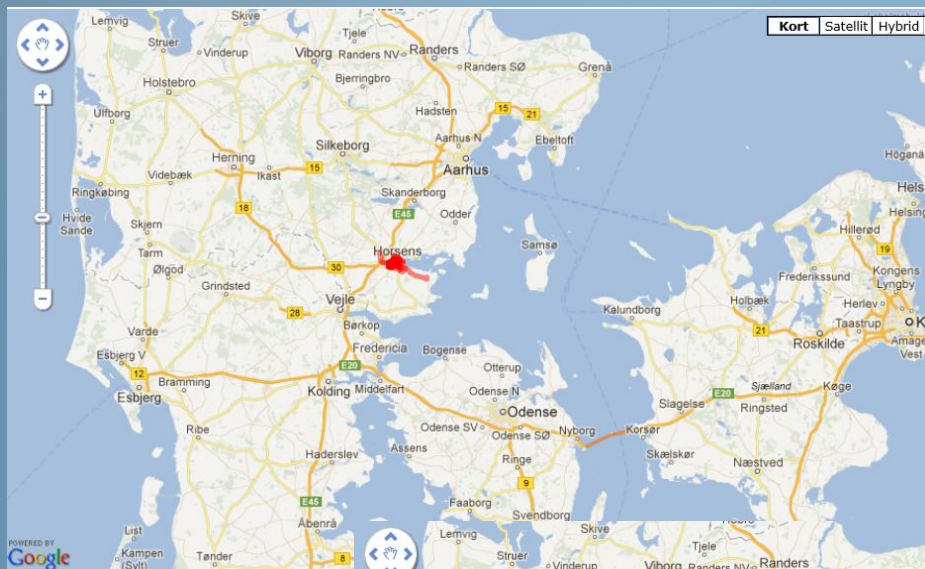


23-10-10 16:21 | **Opgiver snart**

Differences in use / user acceptance?



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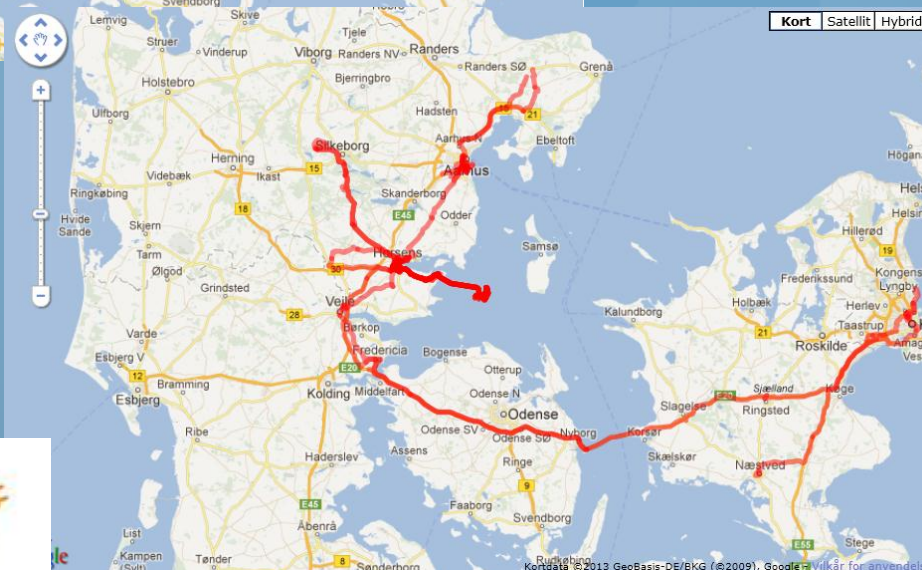
DW35976 – round 8

31. oktober 2011

16. januar 2012

User milage 988 km

Range never
challenged.



DW35976 – round 11

18. juni 2012

27. august 2012

User milage 4132 km

User has blogged
very informative
about several of the
long trips

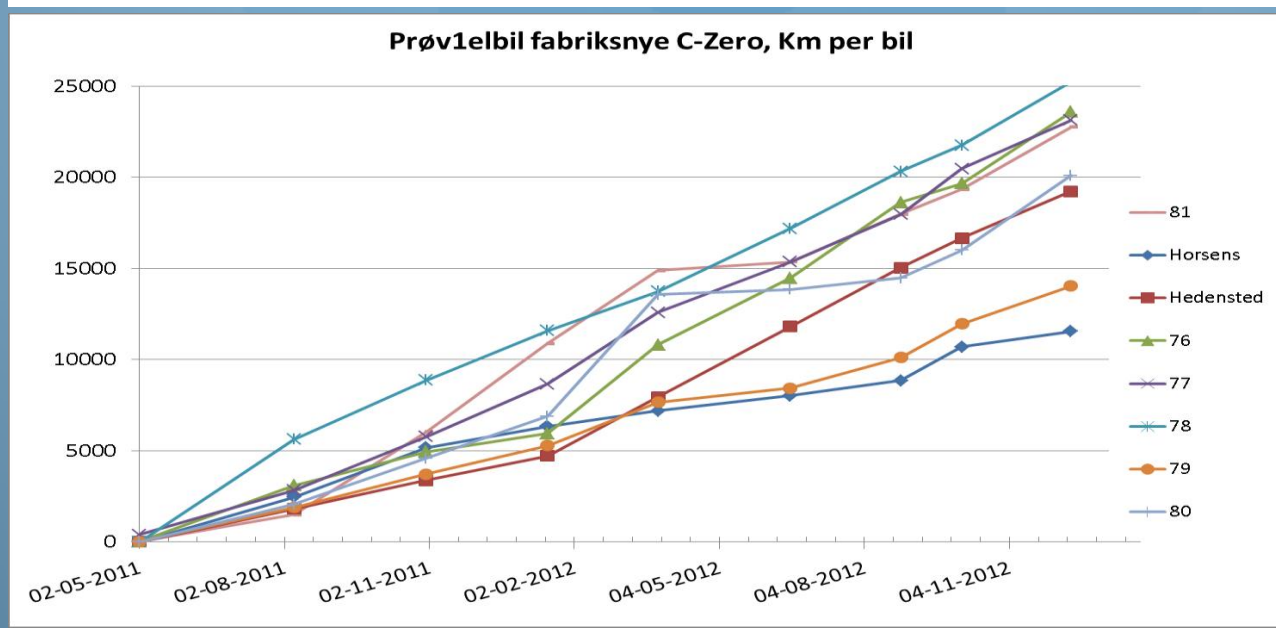
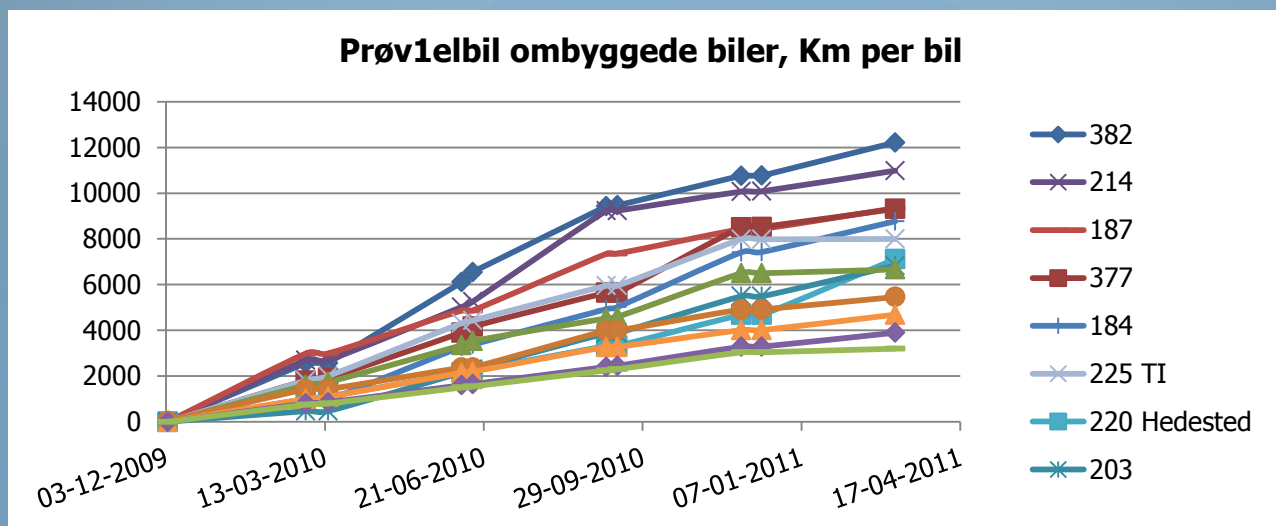


Milage

By end of project end 2012 the total for all cars in the Prøvelbil added up to 256.000 km.



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Charging



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Differentieret elpris og brugeradfærd

00-06	06-24	00-06	06-24	00-06	06-24	00-06	06-24	00-06	06-24	00-06	06-24
kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
424	934	415	697	439	696	667	558	134	822	489	493
31%	69%	37%	63%	39%	61%	54%	46%	14%	86%	50%	50%
NAT	DAG	NAT	DAG	NAT	DAG	NAT	DAG	NAT	DAG	NAT	DAG
Frivillig ladning		Informeret ladning		Frivillig ladning		Styret ladning		Informeret ladning		Motiveret ladning	
Familierunde nr. 6				Familierunde nr. 8				Familierunde nr. 7			

00-06	06-24	00-06	06-24	00-06	06-24	00-06	06-24	00-06	06-24	00-06	06-24
kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
442	875	641	888	194	409	232	205	0	0	340	558
34%	66%	42%	58%	32%	68%	53%	47%	#DIV/0!	#DIV/0!	38%	62%
NAT	DAG	NAT	DAG	NAT	DAG	NAT	DAG	NAT	DAG	NAT	DAG
								0, 0			
Informeret ladning		Styret ladning		Informeret ladning		Motiveret ladning				Informeret ladning	
Familierunde nr. 9				Familierunde nr. 11				Familierunde nr. 13			



Selected Findings from 3 years with EVs



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- The currently sold EVs are suitable as car no 2 today.
- More efficient heating comfort needed
- Demonstration needed.
 - EVs are not understood by people.
- Range is perceived too low by nearly all.
 - Car no 2 must have 200 km range
 - Single car families want 300 km range.
- EVs are perceived too expensive by all test families
 - very few look at total cost of ownership.
- Many quality issues with modified conventional cars.
- Range requirements are likely to come down as fast charge becomes more widely accessible.
- Night time charging at home will require some automatic help.



A very successful project



Private family test:

- >90% finds that they could use an EV.
- The EV is very easy and comfortable to drive.
- > 90% offer to do another (summer) test period
- OEM cars are very reliable
- Charging not an immediate threat to the electric grid

Local community employees like the EVs

New commercial product: Intelligent EV noise

Test-en-elbil – the largest EV demonstration in Denmark

Maritime Electromobility



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- Increasing political pressure for less noise and pollution in lakes, rivers and coastal areas.
- Political pressure to shift away from fossil oil based energy supply.
- A large share of the 57000+ Danish pleasure boats can be repowered with an electric driveline and batteries.
- Tourist and other professional vessels could shift to electric driveline. Typical battery capacity > 150kWh
- New drivelines must be Smart-Grid compatible and provide interface to e.g. optional on-board Photo Voltaics and Fuel Cells and Fast charge.





Handling high energy requires knowledge and proper equipment. Think and take care.



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DTI Electric Energy; Batteries & Fuel Cells lab.



DTI Battery Laboratorium

Battery degradation tester

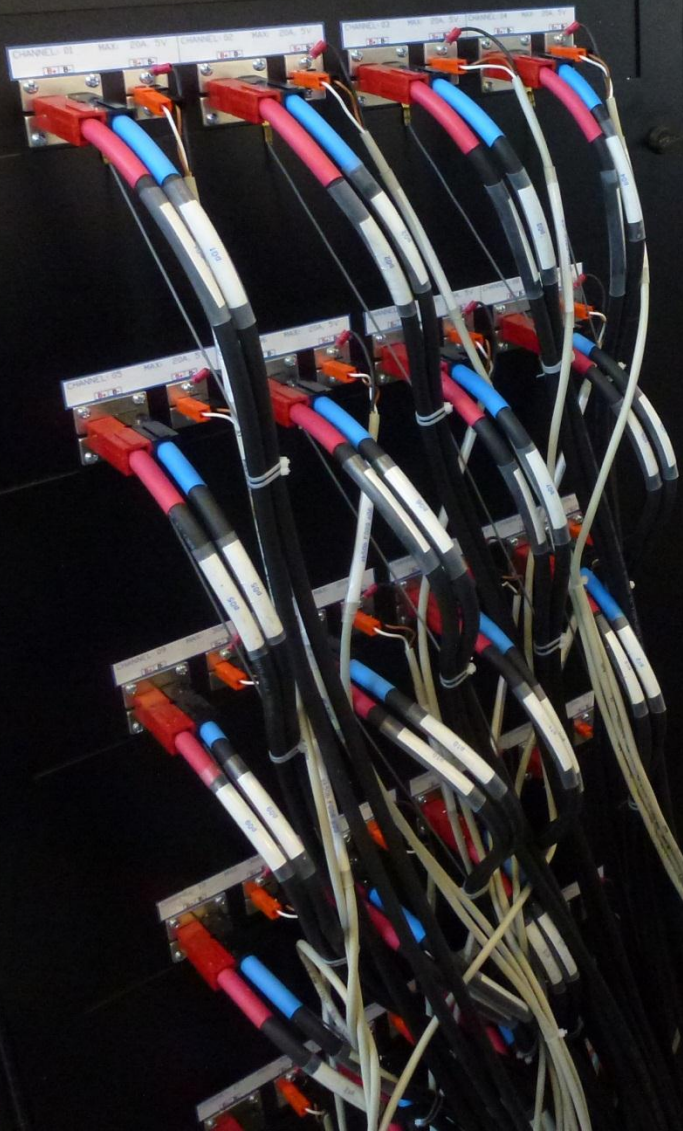


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MACCOR

MACCOR





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Battery degradation model

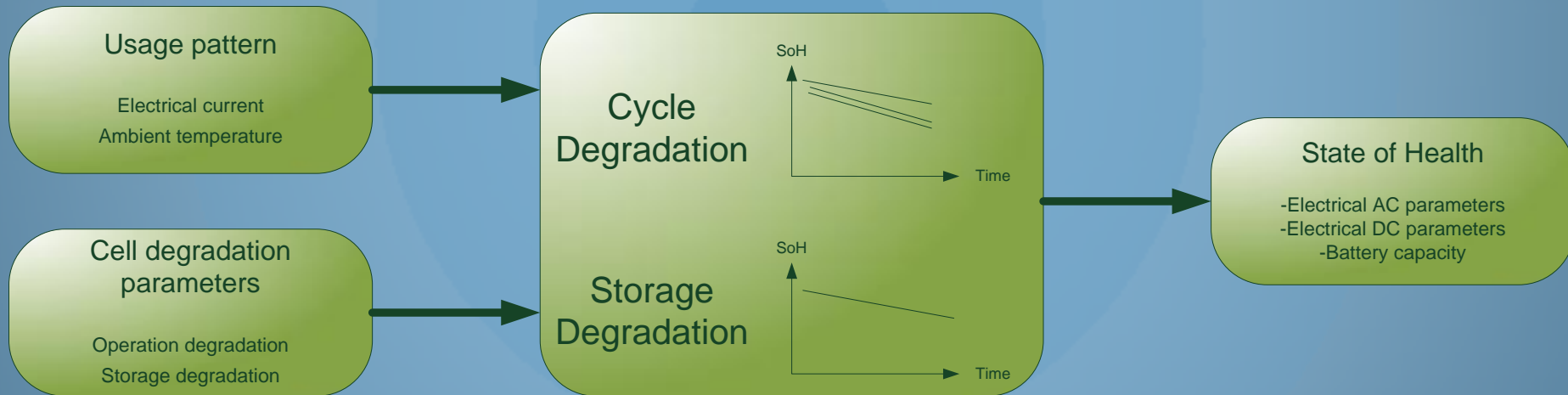


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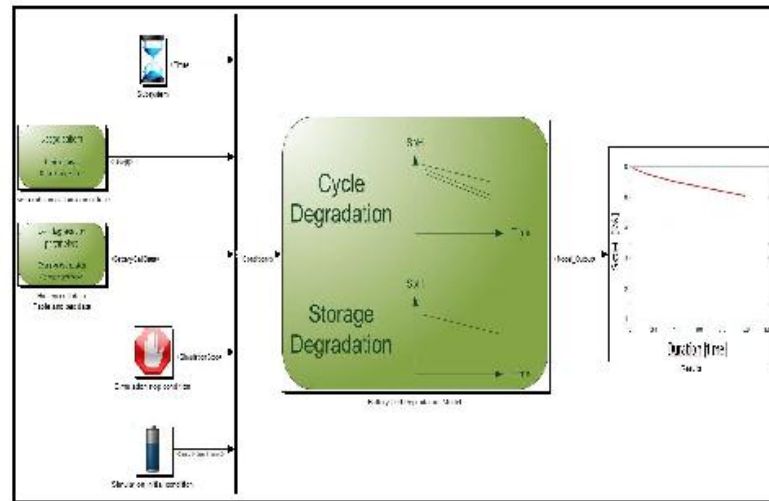
Degradation depends on several parameters

- Temperature
- Discharge rate
- Charge rate
- Depth of discharge
- Ageing

Danish Technological Institute integrate the battery degradation model into a simulation tool for vehicles allowing e.g. comparison between load patterns.



Battery cost model



Model

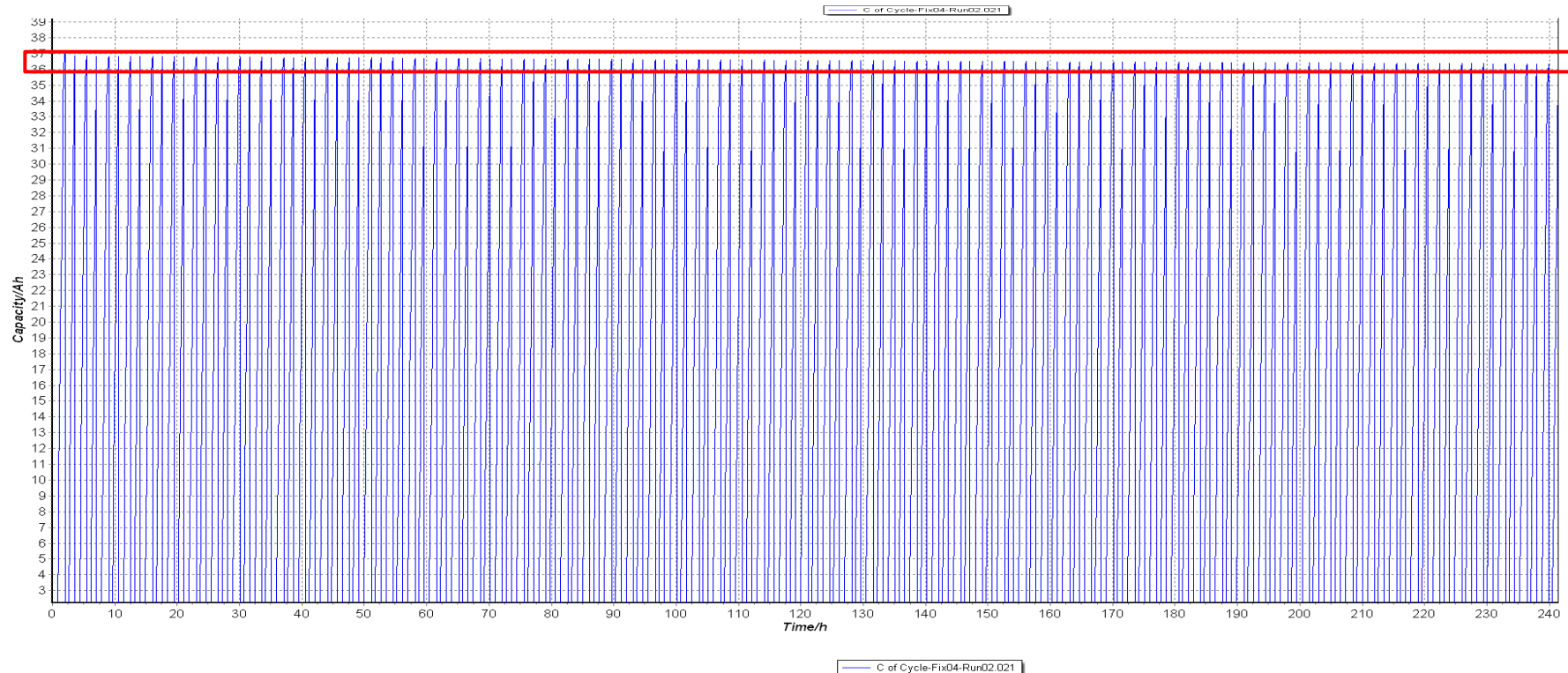
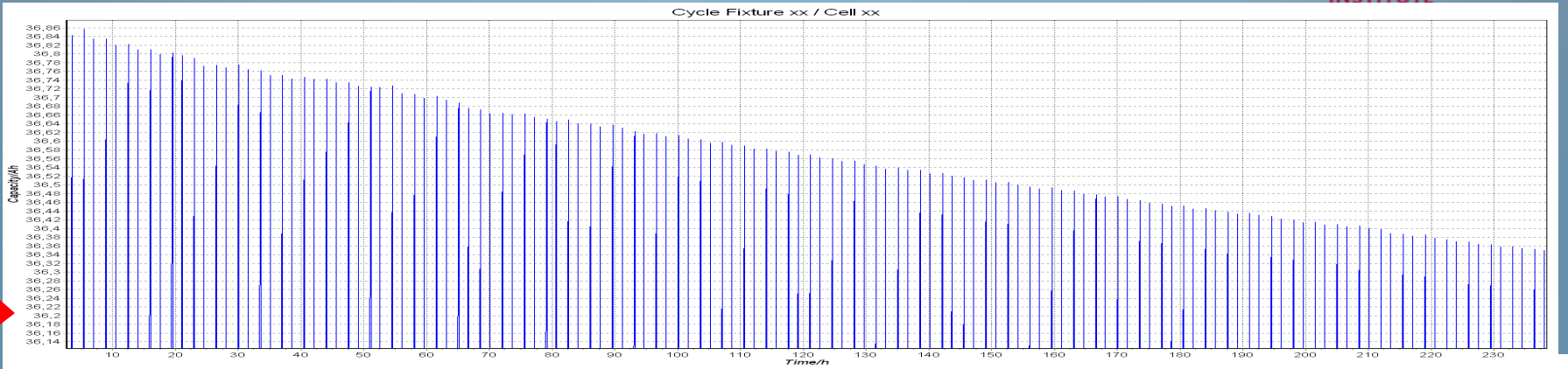


Investments



Costs

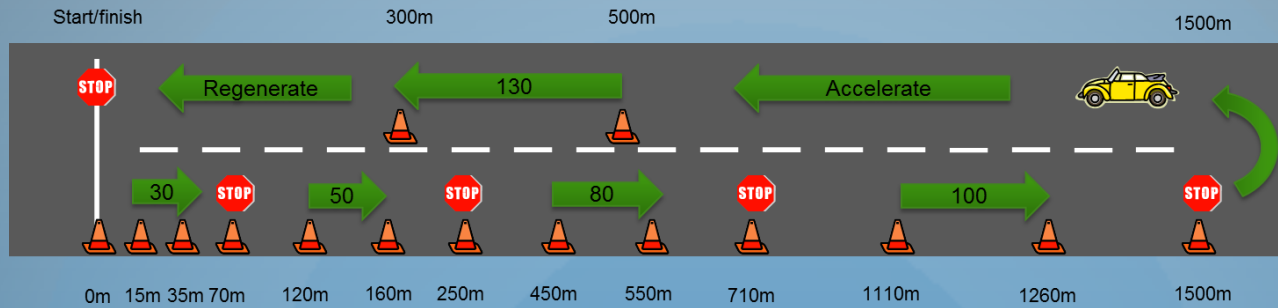
Cycle aging



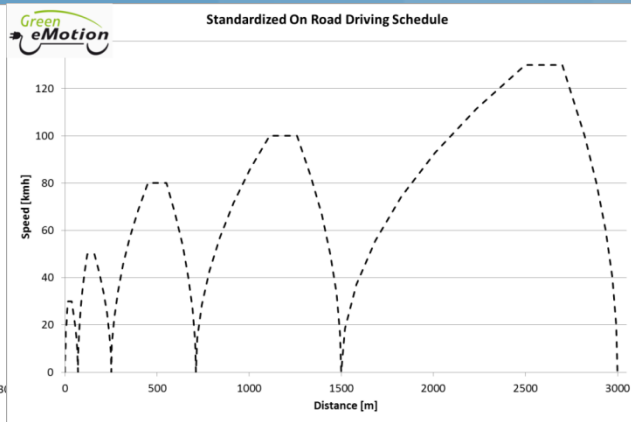
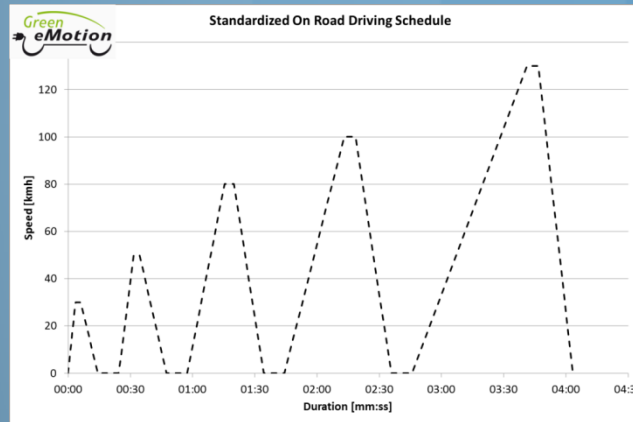
El Bil test på Værløse flyveplads



Test duty cycle for vehicles



STOP = 10 seconds



Battery related services at DTI



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Lab services – examples:

- Datalogging in application (mobile or stationery)
 - Load profile vs battery measurements
- Battery cell test and package test according to standards.
- Capacity Measurement
 - Degradation test (standard or actual load profile)
 - Cycle life / Storage stability
 - Sample test on battery packages
 - Destructive testing (Misuse / overload)
 - Thermal test (Climate chambers with cyclic control)
- Electrochemical Impedance Spectroscopy

Battery specialist – Advice services:

- Energy supply
- Building battery life model for cost estimation
- Application specific Battery specification
- Assistance on finding suppliers and battery selection
- Safety and electric assessment of battery packs (quality and performance)
- Training and education to customer needs.
Example: Safety course based on EN50110

Batteri relaterede service ydelser på Teknologisk Institut



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Laboratorie ydelser– eksempler:

- Hjælp til dataopsamling direkte i applikationen (mobil eller stationær)
 - Måling af belastningsprofil i forhold til batteri
- Test af battericeller og pakker ifølge ønskede standarder
 - Kapacitets målinger
 - Degraderingstest (efter standard eller aktuel bruger belastning profil)
 - Cycle life / Lagringsstabilitet (degradering under opbevaring)
 - Stikprøve test af batteripakker
 - Misbrug/overbelastnings test
 - Termisk test (Klimakammer med cyklisk elektrisk belastning/ladning)
- Elektrokemisk Impedance Spectrografi

Batteri specialist - Rådgivnings ydelser – eksempler:

- Omstilling til batteridrift fra anden energiforsyning
- Opbygning af batterilevetidsmodel, til omkostningsberegninger
- Udvikling af batteri specifikationer / batteri applikationer
- Udvælgelse af batteripakke type and assistance til at finde leverandører
- Sikkerheds og elektrisk vurdering af batteripakker (kvalitet og ydelse)
- Undervisning, standard kurser eller kundetilpassede kurser
 - Eksempelvis: Sikkerhedskursus på baggrund af EN50110



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Thank You.

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